Topical/Local Anesthesia (TLA) for ENT In-Office Procedures

Kevin Hsu, MS, DO, F.A.R.S.
PCOM/Drexel University
Otolaryngology - Head & Neck Surgery
St Elizabeth Med Ctr/Tufts University
Rhinology / Skull Base Surgery Fellow
Topical/Local Anesthesia (TLA)
General Principles

- Properties
  - Reversible nerve blockade
  - Predictable time of onset and duration
  - Relies on principles of permeation and diffusion through water soluble formulation and clinically stable to achieve desired effect

- Mechanism of Action\textsuperscript{2-4}
  - Binds Na+ gated channel
    - Causes influx of Na+ and depolarization of the action potential
    - Prevents propagation of the nerve impulse which extends refractory period for further stimulation.
TLA Mechanisms of Action


See Important Safety Information and full Prescribing Information available from representative.

Copyright © 2012, Lannett Company, Inc.
Common Components of TLAs

Aromatic Ring

Intermediate Linkage

Terminal Amine


See Important Safety Information and full Prescribing Information available from representative.
TLAs: Structure & Attributes

- Onset of action is determined by the exposure of the TLA to the physiologic pH 7.4, which converts the molecule to the lipid soluble structure
- Unionized drug will achieve conversion quicker than ionized
- All TLAs become more ionized at a pH 7.4
  - Proportion of ionized vs unionized varies

TLA Product Classes

Structure examples showing the aromatic ring (lipophilic), ester or amide connector, and the terminal amide (hydrophilic)

Cocaine

Lidocaine

See Important Safety Information and full Prescribing Information available from representative.

Copyright © 2012, Lannett Company, Inc.
Local Anesthesia (General Principles)

Basic Chemistry
- Amides or Esters
  - Generic name with two “I” are amides, and single “I” are esters
  - Amides have lesser incidence of allergic reaction and toxicity
- Properties of formulation that influence activity
  - Lipid solubility
  - Degree of ionization
  - Protein binding

Uptake, Metabolism, and Excretion
- Most local anesthetics diffuse away from site of action, thus vasoactive agents affect diffusion and metabolism
- Laryngeal and tracheal mucous membranes
  - Rapid uptake of local anesthetics
  - Blood levels approach those of IV injection. (ACLS protocol Level)
- Esters Metabolized by plasma esterase and liver
- Amides Metabolized by the liver - caution in those with liver disease
- Both Esters and Amides are excreted by the Kidney, with small percentages of Amides excreted by the biliary system
# Summary of TLA Agents

<table>
<thead>
<tr>
<th>Name</th>
<th>Route of administration</th>
<th>Selected uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cocaine HCl¹</td>
<td>topical</td>
<td>Local anesthesia of accessible mucus membranes or oral, laryngeal, nasal cavities</td>
</tr>
<tr>
<td>Benzocaine²</td>
<td>topical</td>
<td>Minor skin irritations</td>
</tr>
<tr>
<td>Tetracaine HCl³</td>
<td>topical</td>
<td>Ophthalmic/ENT procedures</td>
</tr>
</tbody>
</table>


See Important Safety Information and full Prescribing Information available from representative.
## Summary of TLA Agents (cont’d)

<table>
<thead>
<tr>
<th>Name</th>
<th>Route of administration</th>
<th>Selected uses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amides</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dibucaine&lt;sup&gt;1&lt;/sup&gt;</td>
<td>topical/parenteral&lt;sup&gt;*&lt;/sup&gt;</td>
<td>Minor skin irritations Dental procedures</td>
</tr>
<tr>
<td>Dibucaine HCl&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lidocaine HCl&lt;sup&gt;2-5&lt;/sup&gt;</td>
<td>topical/parenteral&lt;sup&gt;*&lt;/sup&gt;</td>
<td>Dental procedures/nerve block</td>
</tr>
<tr>
<td>Mepivacaine HCl&lt;sup&gt;6&lt;/sup&gt;</td>
<td>parenteral&lt;sup&gt;*&lt;/sup&gt;</td>
<td>Nerve block for dental procedures</td>
</tr>
<tr>
<td>Prilocaine HCl&lt;sup&gt;7,8&lt;/sup&gt;</td>
<td>parenteral&lt;sup&gt;*&lt;/sup&gt;</td>
<td>Dental procedures</td>
</tr>
<tr>
<td>Bupivacaine HCl&lt;sup&gt;9-12&lt;/sup&gt;</td>
<td>parenteral&lt;sup&gt;*&lt;/sup&gt;</td>
<td>Labor/postop analgesia/dental</td>
</tr>
</tbody>
</table>

*Parenteral in this context is intended to mean by subcutaneous or spinal injection, subject to the Prescribing Information of each respective product.

See Important Safety Information and full Prescribing Information available from representative.

Copyright © 2012, Lannett Company, Inc.
Local Anesthesia

**Cocaine**

- Ester
- Unique
  - Only naturally occurring local anesthetic\(^25\)
  - Blocks reuptake of NE and dobutamine
- Excess accumulation accounts for side effects
  - Vasoconstriction, tachycardia, hypertension, mydriasis, cortical stimulation, addiction, and sensitization of the myocardium to catecholamines.
- Drugs that interfere with catecholamine catabolism (ex: MAO-I’s) may potentiate hypertensive crisis
- Detoxified by plasma and liver cholinesterases
  - Increased risk of toxicity in cholinesterase deficiency
- Available 4 % solution
- Max dose 2-3 mg/kg
- Duration 30-60 min
History

- Cocaine, an alkaloid found in the shrub Erythroxylon coca in Bolivia and Peru
- South American Indians used to induce euphoria, reduce hunger, increase work tolerance and tolerate cold since 6th century
- Messages were carried by runners 20 miles stretches over high Andean mountains chewing on these leaves killing hunger and fatigue
- Divine Status By Incas. First Inca Queen was named Mama Coca
- Francisco Pizzaro brought leaves from Peru to the court of Spain and despite objection of religious authorities, it entered commerce using as a payment for the miners to increase productivity and making oppressive working conditions bearable.
Synthetic active alkaloid

- 1857-60: active alkaloid was extracted from Coca leave
- 1884: Koller (assoc. of Freud) first used as a local anesthetic in Ophth. Surgery, William Halsted injected it to get the first nerve block
- 1891: 200 cases of intoxication and 13 deaths
- Concerns about cocaine toxicity and addiction, the search for a safer alternative dates back to 1905
- 1914: Harrison Narcotic Act classifies it with morphine and other narcotics and it drove recreational use underground
- 1973: The National Commission on Marijuana and Drug Abuse recommended eliminating the manufacture of cocaine unless unique therapeutic benefits could be demonstrated
- Current: Heavily Regulated purified cocaine at a consistent concentration and quality control.
Academy as Part of the Debate

- The American Academy of Otolaryngology-Head and Neck Surgery, Inc. considers cocaine to be a valuable anesthetic and vasoconstricting agent when used as part of the treatment of a patient by a physician. No other single drug combines the anesthetic and vasoconstricting properties of cocaine.

- Position statements are approved by the American Academy of Otolaryngology—Head and Neck Surgery, Inc. or Foundation (AAO-HNS/F) Boards of Directors and are typically generated from AAO-HNS/F committees. Once approved by the Academy or Foundation Board of Directors, they become official position statements and are added to the existing position statement library.

- Adopted 12/4/1988
- Submitted for Review 4/13/1995
- Reaffirmed 3/1/1998
- Revised 5/6/2013
- http://www.entnet.org/Practice/policyMedicalUseCocaine.cfm
Cocaine Literature Review

- Cocaine vs Cocaine Slush (adrenaline)
  - Delikan et al, 1978 showed no advantage adding adrenaline to cocaine and increases risks profile in combination with cocaine

- Cocaine vs Tetracaine + Oxymetazoline
  - Bizakis et al, 2004 showed improved pain relieve for tetracaine + oxymethazoline

- Cocaine vs Lignocaine (aka lidocaine)
  - Jonathan et al, 1988 showed improved pain relieve subjective using cocaine than lidocaine

- Cocaine vs Co-phenylcaine (5% lido w 0.5% phenylephrine)
  - Smith et al, 2002 showed no difference

- Cocaine vs saline /Oxymetazoline
  - Wight et al, 1990 showed no difference between oxymetazoline vs cocaine in vasoconstrictive properties.
Study Highlights

- The Laryngoscope/ Lippincott Williams & Wilkins, Inc. © 2004 The American Laryngological, Rhinological and Otological Society, Inc./Medicinal Use of Cocaine: A Shifting Paradigm Over 25 Years

- Heather Long, MD; Howard Greller, MD; Maria Mercurio-Zappala, MS, RPh; Lewis S. Nelson, MD; Robert S. Hoffman, MD

- Important comparison to 1977 survey by Johns and Henderson

- The toxic dose 2-200mg, not dose dependent

- The reasons for decline

- Non medical reasons for decline in people who were using it

- Number of Pts with side effect in proportion to total number treated

- Types of side effects and number of Death

- Not using monitoring in office

- Not considered perioperative use of other medications specially Halothane gas

- How about use of neostigmine, echothiophate.

- What is the Pt’s Cholinesterase status.

- Many physicians, whether or not they had discontinued clinical use of cocaine, wrote that they still believed cocaine to be the best agent for vasoconstriction and local anesthesia.
Method of application

- The most common method of application was the use of 4% liquid solution on nasal pledgets (98%).
- Other methods employed included dripping the solution onto vocal cords, nasal spray, and the use of cocaine crystals on saline-moistened pledgets or cotton-tipped applicators.
- The use of “cocaine mud,” a mixture of cocaine flakes and 1:1000 epinephrine, which has been discouraged since 1924, was reported by 35% of respondents in 1977 but appears to have fallen out of favor.
Clarifications and high lights

- Reuptake of Catecholamines is the major natural means of terminating their effects. Their levels increase in circulation and cause effects such as mydriasis, tachycardia, vasoconstriction.

- Concurrent use with 1:1000, 1:10000 Epinephrine Not advantages and causes more side effects.

- Why doesn’t NE reuptake inhibition cause ischemic effect in brain?

- How does it stimulate CNS?

- What else contribute to cardiac effect?

- How about use of injectable Epi at 1:100,000 and or greater dilution?
Relevant Studies

- Controlled Double Blind Studies demonstrated that 1 to 1.5 mg per Kg use in nasal mucosa produces short lived clinically insignificant sympathomimetic effects and are well tolerated in pts with CAD who have been anesthetized with Nitrous oxide, halothane, and pancuronium bromide.


Clarifications

- Does it absorb from Skin?
- Does it absorb from GI tract?
- Peak serum levels 15 to 60 minutes after intra nasal use. (monitor pt)
- Drug persists in plasma 4-6 hours and still detectable in nasal mucosa up to 3 hrs. (wash the nose)
- Cocaine Mud (add HCO3Na) it creates alkaline environment so slow absorption, rapid onset and increase duration. (Indians chewed Coca w Lime)
- Does it have same absorption from tracheobronchial membrane vs larynx?
- Pseudo-cholinesterase deficiency or atypical cholinesterase (succinylcholine sensitive pts, or pts who are taking cholinesterase inhibitors such as echothiophate eye drops or neostigmine).
Why Cocaine can be the preferred TLA of choice

- Its unique properties as both a topical anesthetic and local vasoconstrictor
- Short time to onset and reasonable duration of action last up to an hour or more make Cocaine an ideal agent for otolaryngology procedures.
- Safe use of Cocaine can be assured with education.
# DEA Scheduling

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Description</th>
</tr>
</thead>
</table>
| I        | • High abuse potential  
           | • No accepted medical use |
| II       | • High abuse potential  
           | • May lead to severe psychological or physical dependence |
| III      | • Some physical dependence; high psychological dependence |
| IV       | • Less abuse potential  
           | • Limited dependence |
| V        | • Low abuse potential |


See Important Safety Information and full Prescribing Information available from representative.

Copyright © 2012, Lannett Company, Inc.
Cocaine: other considerations

- Prescription/Usage of Controlled Substance
  - Patient specific
  - Must order directly from licensed distributor or manufacturer
  - Practitioner’s responsibility to self-regulate and log the following data for inspection (for minimum 2 years)
    - Drug Name, Amount, Strength, inventory, dispenser, receiving patient, expiration date, discard/disposal
    - Adequate safeguard against theft/storage/destruction
    - Monitoring and emergency (resuscitative) treatment cart/supplies
  - Reduced dose on debilitated/elderly/or pediatric patients, and use the lowest dosage necessary to avoid high plasma levels/adverse effects
  - Cocaine is pro-pyogenic and blocks uptake of Norepinephrine and sensitizes catecholamines causing vasoconstriction and mydriasis

- Contraindicated in use on
  - Severe traumatized mucosa
  - Sepsis or infection of the area to be treated
  - Know drug sensitivities
  - Pregnancy (Class – C)
  - Ophthalmic applications (may cause clouding/sloughing of corneal epithelium/ulceration)
Local Anesthesia

**Procaine (Novocain)**
- Ester
- Ineffective topically
- Available 2% solution
- Max Dose 1000mg
- Onset 2-5 min
- Duration 30-90 min
- Metabolized by plasma cholinesterase
Local Anesthesia

Benzocaine (Americaine)

- Ester
- Low water solubility and relatively high oil solubility
  - Used in ointments/oils for topical use on raw or ulcerated surfaces
- Slow uptake
- Low toxicity
- Max dose 200mg
- 30-60 min duration
- Hurricane
  - 20% benzocaine in flavored, water-soluble polyethylene glycol base
  - Excellent topical anesthesia to mucous membranes, rapid onset, short duration, and tastes good
Local Anesthesia

**Tetracaine (Pontocaine)**

- Potent Ester
- 10x toxicity and potency of procaine
- Excellent topical anesthetic
- Commonly used for anesthesia of the endotracheal surface via aerosol.
- Onset 6-12 minutes
- Prolonged duration of action (90-120 minutes).
- Maximum per dose: 1.2 to 1.5 mg/kg (skin prep)
- Max Total dose: 20 mg (Navy VA 120-160mg bronch (applied multiple times? Frequent suction? Complication rate)
- Rapid uptake
  - Only 1 mL of a 2% solution (which contains 20 mg/mL) should be used for topical anesthesia of the upper respiratory tract
Local Anesthesia

Dibucaine

- Amide (the very first amide synthesized in 1928 by Uhlmann) – 10 times more potent than cocaine/lidocaine
- Slow onset of action (15 min)
- Extremely long duration of action > tetracaine and almost equivalent to bupivacaine (>6 hours)
- Used to measure serum cholinesterase activity known as the “Dibucaine Number”
- Due to unfavorable safety profile, injectable application as limited to spinal anesthesia until taken over by a safer agent bupivacaine in 1957
- Maximum total dose 50mg
- Available today mostly in forms of topical applications only
Local Anesthesia

**Lidocaine (Xylocaine)**

- Amide
- Excellent penetrating powers
- Effective by all routes of administration
- Duration 1-3 hrs dependent on epi
- Available 0.5 to 2% or 4% for topical
- Max dose 3 to 4 mg/kg plain or 7mg/kg with epi
- Maximum total dose 300mg
- Used in ventricular arrhythmias
- Also available in a viscous solution
Local Anesthesia

Mepivacaine (Carbocaine)

- Amide
- Similar to lidocaine but less effective for topical use
  - Less vasodilation - longer duration of action when used without epinephrine.
- Maximum per dose = 4.4 mg/kg
- Maximum Total dose = 300mg
- 3% mepivacaine solution available for dental anesthesia.
Local Anesthesia

Prilocaine (Citanest)

- Amide
- Similar to lidocaine but more rapidly metabolized
  - Has a rapid onset
  - Moderate duration of action
  - Profound depth of anesthesia
- Produces less vasodilation - useful without epinephrine.
- Maximum per dose = 6mg/kg
- Maximum Total Dose = 300mg
- Side effect: Methemoglobinemia\(^{23}\)
  - Dose of 600mg+
Local Anesthesia

Bupivacaine (Marcaine, Sensorcaine)

- Amide
- Desirable properties
  - Moderate onset
  - Long duration of action (5-6 hours depending on type of block)
    - Brachial plexus blockade can last 10-12 hours
  - Separation of motor and sensory blockade.
- Used for infiltration, peripheral nerve blockade, and spinal and epidural anesthesia.
- Concentrations range 0.125% to 0.75%.
- Maximum recommended dose is 1.3 to 2 mg/kg.
- Maximum total dose = 175mg
- Toxicity: severe CNS and cardiovascular signs
  - Intractable seizures and cardiovascular collapse
Local Anesthesia

Cetacaine

- Contains benzocaine, butyl aminobenzoate, and tetracaine hydrochloride
- Rapid anesthesia: 30 seconds.
- Maximum recommended dose: 400 mg.
  - Note: A 1-second spray of Cetacaine delivers 200 mg of anesthetic.
- Duration of spray in excess of 2 seconds is contraindicated.
Local Anesthesia

Dyclonine (Dyclone)

- Neither ester or amide, (amino-ketone derivative)
  - Used if patient has allergy to both amides and esters
  - Rapid onset (2-10 minutes) and brief duration of action (30 minutes).
- Commonly used in cephacol products topically, or dental rinse oral topical anesthetic
- Used in a 0.5% topical solution
- Maximum per dose = 4mg/kg
- Maximum dose: 300 mg
Quick Pharmacokinetics
Summary

Fastest Onset

- Injection Lidocaine (0.5-1min) followed by Prilocaine (1-2min), Most of other ones (3-5min), longest Tetracaine (up to 15min)

Duration of Action

- Shortest - Procaine and chloroprocaine (0.25 – 0.5 hours)
- Followed by - lidocaine, cocaine (topical), mepivacaine, and prilocaine, which have slightly longer durations of action (0.5-1.5 hours).
- Longer - The longer-acting agents include tetracaine (3-4 hours), bupivacaine (5-6 hours), etidocaine (3-4 hours), and ropivacaine. Ropivacaine exhibits a duration of 8-13 hours

Topical, local anesthetics reach peak effect at different times when applied to mucous membranes.

- Benzocaine is the fastest (1 minute),
- followed by lidocaine = cocaine < pramoxine < tetracaine < dyclonine and < dibucaine.

- All of the topical products have a duration of action ranging from about 30 minutes to an hour. Cocaine’s effects can last up to 2 hours after topical application, and dibucaine has the longest duration of action at 3-4 hours.
Local Anesthesia (Local Toxicity)

**Local Toxicity**
- Reactions of skin and mesenchymal tissues
  - Cellulitis, ulceration, abscess formation, tissue slough
- Peripheral neuropathy
- Most common causes:
  - Faulty technique
  - Reactions to
    - Agent
    - Preservatives (methylparaben or metabisulfite)\textsuperscript{8-10}
    - Vasoactive agent
Local Anesthesia (Systemic Toxicity)

Systemic Toxicity\textsuperscript{10-13}

- High absorption of local anesthetic or epinephrine into circulation from
  - Rapid absorption
  - Excessive dose
  - Inadequate metabolism/redistribution
- Allergy
  - True allergy less common than administration of excess dose or inadvertent IM injection
- Methemoglobinemia
  - Caused by excessive administration of local/topical anesthetics (i.e. cetacaine sprays)
### TABLE 37-2. LOCAL ANESTHETIC TOXIC SYMPTOMS

**Central nervous system: Excitation**
- Cerebral cortex → excitement, disorientation, rambling speech → seizures
- Brain stem → tachycardia, hypertension, vomiting, sweating

**Central nervous system: Depression**
- Cerebral cortex → coma
- Brain stem → bradycardia, hypotension, apnea

**Cardiovascular system: Depression**
- Bradycardia
- Hypotension
- Shock
- Cardiorespiratory arrest
- Death
Local Anesthesia

- Treatment of Toxicity
  - ABCs
  - Benzodiazepines and barbituates
    - For excitation and seizures
  - Beta blockers
    - For epinephrine toxicity
  - Methylene blue at 1-2mg/kg
    - For methemoglobinemia from prilocaine (dose 600mg+ in adults)

- True allergic reactions are infrequent (<1% of adverse reaction)\textsuperscript{11}
  - Treat as any other form of anaphylaxis

- Use opposite class of local anesthetic if true allergy expected
  - Dyclonine is a good alternative to both (neither ester or amide)
TABLE 37-3. PREVENTION AND TREATMENT OF LOCAL ANESTHETIC TOXICITY

1. Prophylaxisa.
   A. Avoid overdose
   B. Diazepam (Valium) premedication
2. Maintain verbal contact with patient throughout surgery; must be alert to early signs and symptoms of excitation
3. Have an IV in place before administration of local anesthetics
4. When toxic symptoms appear, stop surgery, give oxygen
5. Maintain airway and ventilation
6. Avoid giving further depressants if possible. However, IV diazepam or pentothal may be required to terminate seizure
7. Apply fluid or pressor resuscitation as required
### TABLE 37-4. CONCENTRATION AND MAXIMUM SAFE DOSES OF LOCAL ANESTHETICS

<table>
<thead>
<tr>
<th>Anesthetic</th>
<th>Topical</th>
<th>Infiltration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Concentration</td>
<td>Maximum Dose</td>
</tr>
<tr>
<td><strong>Esters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cocaine</td>
<td>4%-10%*</td>
<td>3 mg/kg</td>
</tr>
<tr>
<td>Procaine (Novocain)</td>
<td>… Not effective …</td>
<td></td>
</tr>
<tr>
<td>Tetracaine (Pontocaine)</td>
<td>0.5%-2%</td>
<td>1 mg/kg</td>
</tr>
<tr>
<td>Chloroprocaine</td>
<td>… Not effective …</td>
<td></td>
</tr>
<tr>
<td>(Nesacaine)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzocaine (Americaine)</td>
<td>20%</td>
<td>200 mg</td>
</tr>
<tr>
<td><strong>Amides</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lidocaine (Xylocaine)</td>
<td>2%-4%</td>
<td>3 mg/kg</td>
</tr>
<tr>
<td>Mepivacaine (Carbocaine)</td>
<td>… Not effective …</td>
<td></td>
</tr>
<tr>
<td>Prilocaine (Citanest)</td>
<td>… Not effective …</td>
<td></td>
</tr>
<tr>
<td>Bupivacaine (Marcaine)</td>
<td>… Not effective …</td>
<td></td>
</tr>
<tr>
<td>Ropivacaine (Naropin)</td>
<td>… Not effective …</td>
<td></td>
</tr>
<tr>
<td>Etidocaine (Duranest)</td>
<td>… Not used …</td>
<td></td>
</tr>
<tr>
<td>Dibucaine (Nupercaine)</td>
<td>1.0%</td>
<td>50 mg</td>
</tr>
<tr>
<td><strong>Piperidine</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dyclonine (Dyclone)</td>
<td>0.5%</td>
<td>4 mg/kg</td>
</tr>
<tr>
<td>Epinephrine*b</td>
<td>1:1000-1:100,0001 mg</td>
<td>1:1000-1:100,0001 mg</td>
</tr>
</tbody>
</table>

---

*10% solution = 100 mg/mL; 1% solution = 10 mg/mL.

bWith halothane anesthesia, 10 mL of 1:100,000 (0.1 mg) can be used over a 10-minute period or 30 mL over 1 hour (0.3 mg).
Other Considerations of TLA for Office procedure

- Besides dose related toxicity to each TLA there are some other issues need to be considered
  - logistics
  - monitoring
  - administration of TLA
  - if the agent used is part of the list of federally controlled substance
Addition of Vasoconstrictors

Epinephrine

- Most commonly used
- Injectable optimal ratio of local anesthetic to epinephrine is 1:200,000 (1mg/200mL)
- Concentration of epinephrine
  - >200,000
    - RCT showed no added benefit on potentiating the local anesthetics and hemostasis by Moshaver et al.
  - <200,000
    - Showed decreased hemostasis and therefore decreased potentiation effect of epinephrine

Premedication

- Goals of premedication:
  - Anxiolysis/Sedation
  - Amnesia
  - Antiemesis with or without analgesia
  - Decreased airway secretions
  - Decreased gastric volume/acidity
- No ideal premedication regimen exists

**Figure from Lee KJ, 2010**
Premedication

Benzodiazepines

- Reliably provide amnesia, reduced anxiety, and increased seizure threshold without undue respiratory or cardiovascular depression\(^{31}\)
  - Seizure protection important benefit when local anesthetics are used as well
- Most commonly used
  - Diazepam (Valium) 2, 5, or 10 mg PO/IM/IV prior to procedure
  - Midazolam (Versed) 0.5- or 1 mg/kg IM or titration of 1 to 2 mg/kg IV
  - Lorazepam (Ativan) 0.5, 1, or 2 mg PO/IM/IV prior to procedure

- To reverse the effect of Benzodiazepine toxicity => administer Flumazenil (Romazicon)
  - Benzodiazepine antagonist
  - Recommended dose is 200 \(\mu\)g IV over 15 seconds
    - May repeat q 60 seconds x 4 doses (1 mg total)
    - No more than 3 mg over 1 hour advised\(^{32}\)
Premedication

Barbiturates

- Preoperative sedation
- Oral or parenteral
- Contraindicated in certain types of porphyria
- Commonly used
  - Secobarbital (Seconal)
    - PO: 50-200mg (adult)
    - Onset 60-90 mins with duration of 4+ hours
  - Pentobarbital (Nembutal)
    - PO or IM: 50-200mg
- Relatively long acting: less suitable for shorter procedures.
Premedication

Compazine (Prochlorperazine)
- 5 to 10mg PO
- Antiemetic, anxiolytic, antipsychotic multi-purpose
- Excellent agent for ambulatory procedures
- Side effect: extrapyramidal symptoms

Haldol
- Long-acting (antipsychotic, anxiolytic, sedative)
- 5 or 10mg PO/IM/IV
- Used only if patient maintained on it chronically
- Side effect: extrapyramidal symptoms
Premedication

Antihistamines

- Hydroxyzine (Vistaril, Atarax)
  - Also antiemetic
  - Used to potentiate the effects of opioids.
  - PO or IM: 25-100 mg
- Diphenhydramine (Benadryl)
  - Sedative, anticholinergic and antiemetic
  - PO, IM, or IV: 25-50mg
  - Blocks histamine release
    - Used as prophylaxis for potential allergic reactions with steroids and H₂ blockers
Applications of Local Anesthetics in ENT

In office procedures
- Laryngology
- Otology
- Rhinology
- General Otolaryngology
Larynx/Trachea

Innervation: superior and inferior laryngeal nerves

Topical block
- Administration to piriform sinuses, vocal folds, and epiglottis

Local anesthesia
- Percutaneous infiltration around superior laryngeal nerve as it pierces the thyrohyoid membrane.
- Trans-tracheal application requires insertion of a 25-gauge needle through the cricothyroid membrane in midline
Larynx/Trachea

(1) Palpate the greater cornu of the hyoid bone.

(2) Insert 25-gauge needle approximately 1 cm caudal greater cornu

(3) Insert needle depth of 1 cm until the firm consistency of thyrohyoid membrane is identified

(4) Inject 3 mL of local anesthetic solution

Figure from Lee KJ, 2010
(1) Introduce 25-gauge needle midline between thyroid and cricoid cartilages.

(2) Puncture cricothyroid membrane.
   • Readily felt as a “pop”
   • Free aspiration of air with the attached syringe verifies intratracheal position of the needle tip.

(3) Instill 4 mL of local anesthetic

*Additional topical application of local anesthesia to oropharynx required for adequate visualization for laryngoscopy and tracheoscopy.

Figure from Lee KJ, 2010
Reduction of TMJ (KJ Lee)

(1) With the head of the condyloid process locked anteriorly, palpate depression of glenoid fossa

(2) Insert needle into the depression, directing anteriorly toward the head of the condyloid process

(3) Slightly withdraw needle when condyloid process contracted

(4) Instill 2 mL of local anesthetic into capsule

Figure from Lee KJ, 2010
Reduction and Fixation of Facial Fractures

Requires adequate anesthesia of

- $V_2$
  - Access near its exit from skull through foramen ovale

- $V_3$
  - Access in pterygopalatine fossa near foramen rotundum, where nerve exits from the skull.

- Superficial branches of cervical plexus.

Most common complication: hemorrhage into cheek
Reduction and Fixation of Facial Fractures (KJ Lee)

Block of superficial branches of cervical plexus
- Palpate posterior margin of sternocleidomastoid
- Inject 10-15mL of anesthetic

Figure from Lee KJ, 2010
Reduction and Fixation of Facial Fractures (KJ Lee)

(1) Raise two skin wheals
   - Midpoint between the condyle and coronoid process
   - Just below the zygoma

(2) Introduce an 8-cm needle perpendicular to the skin until contact with pterygoid plate
   - Usually depth of 4 cm

(3) Withdraw needle, then reinsert slightly posterior to depth of 6 cm

(4) When paresthesia in mandibular division elicited, fix the needle and inject 5 mL of anesthetic

Figure from Lee KJ, 2010
Reduction and Fixation of Facial Fractures (KJ Lee)

1. Raise a skin wheal just over the posterior inferior surface of mandibular notch

2. Insert an 8-cm needle transversely and slightly anterior until contact with lateral pterygoid plate.
   - Depth of 4-5 cm

3. Slightly withdraw and direct in a more anterosuperior direction
   - Will pass anterior to pterygoid plate into the pterygopalatine fossa

4. Advance needle 0.5-1.5 cm until paresthesia is elicited then inject 5-10 mL of anesthetic

Figure from Lee KJ, 2010
Otology (KJ Lee)

- The middle ear Sensory innervation through tympanic plexus
- V3—auriculotemporal nerve
- IX—Jacobson nerve
- X—auricular nerve

Figure from Lee KJ, 2010
Otology

Myringotomy
- Inject the cartilaginous and bony junction of EAC.
- Instead of introducing local anesthetic through the classic 12, 3, 6, and 9 o’clock infiltration, infiltrate at 12, 2, 4, 6, 8, and 10 o’clock.
- After the first injection, the subsequent injection sites are already anesthetized before the needle prick.

Stapedectomy
- In addition to myringotomy, need to infiltrate the tympanomeatal flap.

Tympanomastoid
- Usually performed under general anesthesia.
- In addition to the stapedectomy infiltration, postauricular and conchal infiltration are necessary. The skin of the anterior canal wall needs to be anesthetized if surgery is to include that anatomic site.

Complications
- Temporal facial nerve paralysis.
- Violent vertigo and nystagmus.
- Both result from local in the middle ear and resolve.
Nasal Surgery

- Nasal Polypectomy
  - Cocaine pledgets
  - Along the mucosal surfaces, as well as those in contact with the sphenopalatine ganglion

- Septoplasty and Rhinoplasty
  - Cocaine pledgets and injection of local
  - See figures
  - Allow 20 minutes for optimal results
Vascularization of Nasal Cavity

Lateral Wall Vasculature

Nasal Septum Vasculature
Innervation

Figure from Netters
Neurovascular Supply
Sinus Surgery

- Caldwell-Luc Operation
  - Block infraorbital nerve, sphenopalatine ganglion, and posterior superior dental nerve
    - Introduce local through the greater palatine foramen via a curved needle.
  - Apply further topical anesthesia with cocaine pledgets intranasally against the sphenopalatine ganglion
  - Local infiltration of mucosa in the canine fossa supplies hemostasis needed over the line of incision

- Ethmoid sinus innervated by
  - Anterior ethmoid nerve (branch of the nasociliary, V1)
  - Posterior ethmoid nerve (branch of the infratrochlear, VI)

- Sphenoid sinus innervated by
  - Pharyngeal branch of the maxillary nerve
  - Posterior ethmoid nerve
Nasal Surgery (KJ Lee)

Figure from Lee KJ, 2010
Local Injection

- 2% lidocaine with epinephrine 1:200,000
- 1 – 2 cc per side
- Injected into the neck of the middle turbinate and the uncinate plate
Typical In-Office Balloon Sinuplasty Setup

1. Premedication
   • 5-10 mins prior to administration of local anesthetics
   • Valium, Clonidine, or Percocet

2. Topical options: pledges for 15 mins
   • Cocaine
   • Lidocaine/Oxymetazolin
   • Lidocaine/Neo-synephrine
   • Lidocaine/Epinephrine
   • Tetracaine/Oxymetazolin
   • Tetracaine/Neo-synephrine
   • Tetracaine/Epinephrine

3. Injection
   • If hemostasis desired: Lidocaine 1-2 % with 1:200,000 epinephrine for addition local blocks and hemostasis
     • Allow at least 10 minutes for maximal effect
   • Lidocaine 1-2% if hemostasis is not a concern

4. Total time prior to actual procedure 30-45 minutes

5. Practitioner should individualized steps and duration to maximize procedure efficiency and patient comfort
Office Sinuplasty

- 2 or more assistant
- Chair / Bed
- Pts usually choose local anesthesia over general
- Choose pts that tolerate nasal endoscopy and have reasonable access to OMC
Office sinuplasty

- Consent
- Pt education
- Decongestant, Topical and local anesthesia
- Room set up
- Staff education
- Valium/ ativan preop
- Analgesics post-op

- CT images
- Choose balloon size
- Keep anxiety inducing conversations minimum
- Inform pt of the progress during the case
- Warn about the pain, light, teeth
Problems

- May get a bad rep if pt did not tol.
- Lose money on post op debridments
- Increase overhead
- Equipment need

Solutions

- Excellent rep to save time, low risk and as easy as going to the dentist
- Good word of the mouth inc pt flow
- Facility Fee & great reimbursement
- Your time is money
- Buy refurbished equip
Is In-Office BSP Right for Your Practice?

Questions to consider as you move into the office:

- Will patients come to the office?
- Is reimbursement favorable?
- Do I have the equipment I need to support In-Office BSP cases?
- How do I create the best experience for my patients?
- Do I have access to properly trained staff?
- Can my own staff be trained to assist?
- What’s the best local anesthesia?
- Will I be able to transfer my best practices from the OR to my office?
- How do I mitigate risks?
- How will In-Office cases affect my OR cases?
# The BSP In-Office patient experience

**In-office procedure**
- No fasting period
- Local Anesthesia
- Wear own clothes
- Potential out of pocket savings\(^1\)
- Most patients return to normal activity within 2 days\(^2\)

**Hospital surgery**
- Fasting prior to surgery
- General Anesthesia
- Hospital gown
- Intubation and IV

---

1. Some eligible patients may have lower out-of-pocket costs if the procedure is performed in a lower cost of care setting, such as a physician’s office.

2. For out-of-office procedures, duration varies depending on the type of procedure. Typical recovery time is 2–3 days for most patients.
Instrument Set-Up
Patient Anxiety

- Valium??
- Verbal Anesthesia
- Well trained staff/surgeon- Rehearse!
Pre-Procedure Process

- Patient Briefing
  - Afrin Spray
  - 75% Tetracaine 2%/25% Afrin Pledgee
  - 2% Lido injection/ 2% Tetracaine jelly
  - Balloon dilation

ORIOS 2 data showed that most procedures last less than an hour¹

¹Data on File #8
Tell The Patient What to Expect
Tell The Patient What to Expect

Pain

- As the sinus is dilated you will hear a crackling sound. This sound is normal, and it means the sinus is opening.

- You may or may not experience pain

- Provide examples to the patient:
  - This procedure will likely cause some discomfort
  - Any pain you feel will likely be brief

- Patient should bring appropriate oral analgesics
  - Additional analgesics should also be available in the office for post-procedure pain relief
Summary

- Local Anesthetics are great alternative for short, in-office procedures.
- Thorough understanding of pitfalls and toxicities of local anesthetics will allow otolaryngologists to perform in-office procedure safely and maximize patient comfort.
- Use of pre-medication potentiates effect of local anesthetics.
- Precise techniques for anatomic local blocks maximize the effect of local anesthesia and minimize the volume required to achieve the desired nerve block.
- Additional use of vasoconstrictors allows for improved local anesthesia and hemostasis.
- Importance of Patient education and in-Office setup/preparation.
References

34. Egan TD. The clinical pharmacology of the new fentanyl congeners. IARS 1997 Review Course Lectures.
41. Moore M, Weiskopf RB, Eger EI, II. Arrhythmogenic doses of epinephrine are similar during desflurane or isoflurane anesthesia in humans. *Anesthesiology.* 1993;77:943-947.